

We Claim:

1 1. A method of detecting knock in an internal combustion engine by means of at
2 least one knock sensor that generates a knock sensor signal, said method
3 comprising the steps of:
4 a) measuring a signal strength of said knock sensor signal during
5 operation of said internal combustion engine;
6 b) determining a reference level for said knock sensor signal, said
7 reference level varying according to a noise level or sound level of the internal
8 combustion engine;
9 c) limiting an increase in the reference level in a predetermined manner
10 considering at least one of an allowed reference level range and a gradient that
11 is a measure of an amount of reference level change; and
12 d) establishing whether or not knock is occurring by comparing said signal
13 strength obtain during the measuring of step a) with said reference level that is
14 limited according to step c).

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1 2. The method as defined in claim 1, wherein the internal combustion engine has
2 a plurality of cylinders and said increase in the reference level for an individual
3 cylinder is limited during the limiting considering a part of said sound level
4 produced by a number of said cylinders.

1 3. The method as defined in claim 2, wherein said number of said cylinders
2 consists of all of said cylinders.

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1 4. The method as defined in claim 1, wherein the internal combustion engine has
2 a plurality of cylinders, said allowed reference number range is formed according
3 to a part of said sound level produced by a number of said cylinders and said
4 increase in the reference level for an individual cylinder is limited during the
5 limiting when a new reference level is outside of the allowed reference level
6 range.

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1 5. The method as defined in claim 4, wherein said number of said cylinders
2 consists of all of said cylinders.

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1 6. The method as defined in claim 1, wherein the internal combustion engine has
2 a plurality of cylinders, said increase in the reference level is limited during the
3 limiting when a new reference level for an individual cylinder is greater than a
4 predetermined value and said predetermined value is derived from a part of said
5 sound level produced by a number of said cylinders.

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1 7. The method as defined in claim 6, wherein said number of said cylinders
2 consists of all of said cylinders.

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1 8. The method as defined in claim 1, wherein the increase of the reference level
2 is limited when the increase in the gradient of the sound level is greater than a
3 predetermined gradient threshold.

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1 9. The method as defined in claim 1, wherein the internal combustion engine has
2 a plurality of cylinders and the reference level range for limiting the increase in
3 the reference level is determined from the average value of the reference levels
4 of a number of said cylinders plus a predetermined reference level threshold
5 value.

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1 10. The method as defined in claim 9, wherein said number of said cylinders
2 consist of all of said cylinders.

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1 11. The method as defined in claim 9, wherein the reference level threshold
2 value for the gradient is formed from the average value of the gradients of said
3 number of said cylinders plus a further predetermined gradient threshold value.

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1 12. The method as defined in claim 9, wherein said number of said cylinders
2 does not consist of all cylinders but only those cylinders satisfying a
3 predetermined cylinder selection criteria.

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1 13. The method as defined in claim 12, wherein said predetermined cylinder
2 selection criteria for each of said cylinders is based on the magnitude of a

3 contribution to said sound level of the internal combustion engine from each of
4 said cylinders.

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1 14. The method as defined in claim 12, wherein said cylinders are divided into
2 groups, one of said groups including cylinders generating a greatest amount of
3 sound and another said groups including cylinders generating a least amount of
4 sound.

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1 15. The method as defined in claim 1, further comprising amplifying the knock
2 sensor signal prior to the measuring of the signal strength.

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1 16. An apparatus for knock detection in an internal combustion engine having a
2 processor and a control unit, said apparatus comprising
3 at least one knock sensor that generates a knock sensor signal;
4 means for measuring a signal strength of said knock sensor signal during
5 operation of said internal combustion engine;
6 means for determining a reference level for said sensor signal, said
7 reference level varying according to a noise level or sound level of the internal
8 combustion engine;
9 means for limiting increases in the reference level in a predetermined
10 manner considering at least one of an allowed reference level range and a
11 gradient that is a measure of an amount of reference level change; and

12 means for establishing whether or not knock is occurring in the internal
13 combustion engine by comparing said signal strength obtain during the
14 measuring by the means for measuring with said reference level that is limited
15 according to the means for limiting;

16 wherein said means for establishing whether or not knock is occurring,
17 said means for limiting, said means for determining and said means for
18 measuring are located in at least one of said processor and said control unit.